SHIP PRODUCTION COMMITTEE
FACILITIES AND ENVIRONMENTAL EFFECTS
SURFACE PREPARATION AND COATINGS
DESIGN/PRODUCTION INTEGRATION
HUMAN RESOURCE INNOVATION
MARINE INDUSTRY STANDARDS
WELDING
INDUSTRIAL ENGINEERING
EDUCATION AND TRAINING

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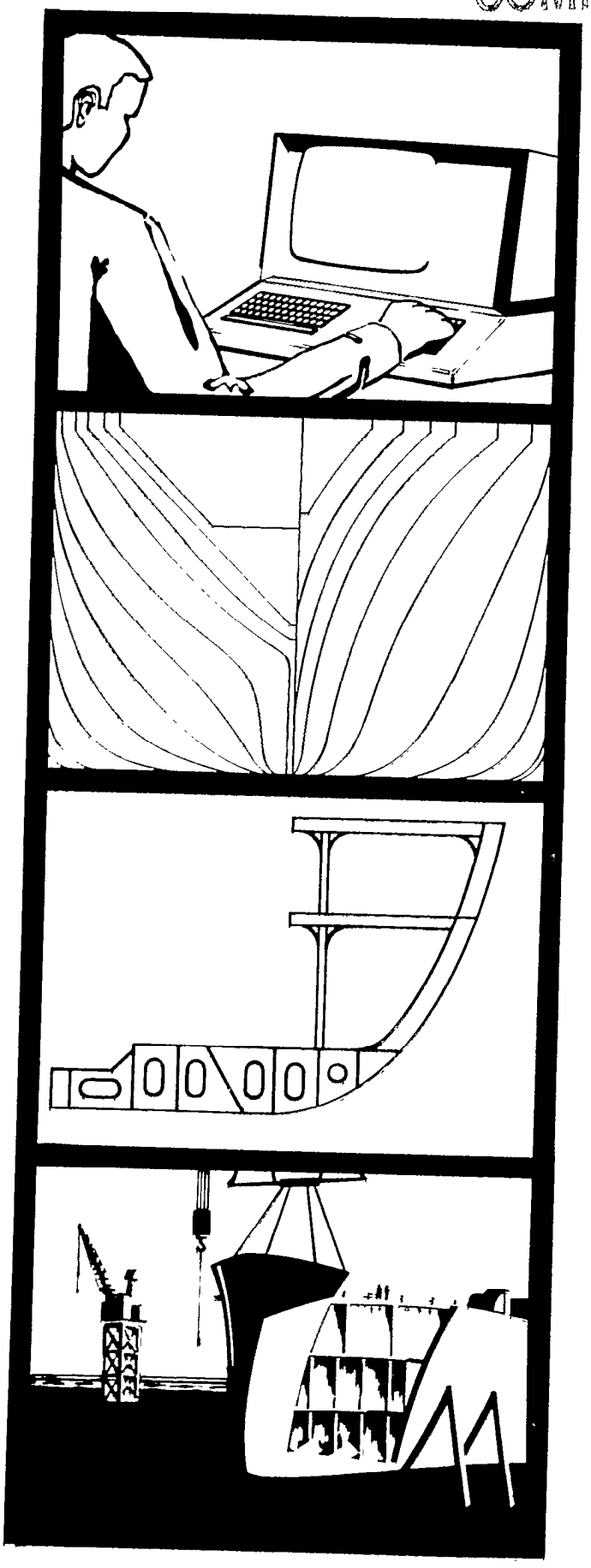

R ESEARCH
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E NGINEERING
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AND
P RODUCTIVITY
IN
S HIPBUILDING

Proceedings of the REAPS Technical Symposium September 11-13, 1979 San Diego, California

THE SHIPBUILDING TECHNOLOGY TRANSFER PROGRAM

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Mr. Roper has previously served as Director of Business Development for Ingalls Shipbuilding, and President of Paden-Roper Associates, Inc, management consultants. He has more recently completed a two-week tour and study of shipyards in Japan.

One of the most innovative ideas to come along in the shipbuilding industry in a very long time is the one that inspired the Shipbuilding Technology Transfer Program (TTP). The idea evolved from a long and tedious, but finally successful, attempt by Levingston Shipbuilding Company (LSCo) to secure a contract for the construction of five 36,000 DWT dry bulk carriers. These ships were to be built to a modified design of the Future-32 class ships previously designed and built by Ishikawajima-Harima Heavy Industries (IHI) of Japan.

Because the design was to be modified to provide two medium-size diesel engines instead of the single engine in the original design, Levingston contracted with IHI for on-site design engineering support. It was at this point when the idea of transferring Japanese production technology occurred to the Levingston management.

The American shipbuilding industry is well aware of the significant cost differences between the Japanese and ourselves. Many reasons have been offered to explain this differential and whether the reasons are valid or not, the fact remains that Japanese yards are consistently able to offer ships at a price one-half to two-thirds below American prices. Obviously, these Japanese companies are also making a profit and doing it without benefit of government subsidy.

Seeing this tremendous difference firsthand in their own estimate of the slightly modified bulkers, Levingston management decided to not only find out why but to attempt to determine precise differences between IHI and LSCo engineering and design practices; production planning and control methods; facilities, production processes, methods and techniques; quality assurance methods; and personnel organization, operations, and training. The obvious objective of such studies was to identify, examine and implement the Japanese systems, methods and processes which appeared to be applicable to Levingston and which promised a significant improvement in the LSCo design/production process.

With this objective in mind, LSCo initiated a subcontract with IHI Marine Technology Inc. (an American corporation) specifying the areas to be explored and the number and types of IHI consulting personnel required during the period of re-design and initial construction of the first bulkers.

Subsequently, recognizing the potential application of TTProgram results to the American shipbuilding industry, LSCo initiated a cost-sharing contract with MarAd to provide documentation and industry seminars to reveal program findings and production improvement results measured during production of the bulkers.

The program is now into its 11th month of operation. IHI consultants have worked side-by-side with LSCo personnel in virtually every area of ship design and construction. The program is precisely organized to: 1) study IHI systems, methods and techniques; 2) compare the LSCo and IHI practices; 3) identify improvements to the LSCo systems; 4) implement approved changes; and 5) document program findings, changes to the LSCo systems, and the results of those changes.

Basically, the program is organized into six major task areas:

1 - Cost Accounting
2 - Engineering and Design
3 - Planning and Production Control
4 - Facilities and Industrial Engineering
5 - Quality Assurance
6 - Industrial Relations

(See Figure 1)

Beneath each of these major tasks are a series of sub-tasks which further delineate discrete areas of investigation and study. These sub-task areas are shown in Figures 2 through 7.

A task leader and a task coordinator is assigned to each major task area. These personnel are directed by means of work orders, schedules and standard procedures from the Technology Transfer Program Office at Levingston. IHI consultants are assigned by a resident IHI Program Manager to each of the task areas as required by workload and program schedules.

Program activities have increased from a beginning manpower level of three to a maximum of twenty people full-time dedicated to Technology Transfer. As the program accelerated in the first few months, the full potential of the program became manifest but the detail study and assimilation of the Japanese concepts and practices was, and at this writing still is, a tedious process. Significant findings in each task area have

been obtained and some of these findings are being applied to the Levingston production system. Implementation of accepted changes is now occurring in production planning and control; facilities and equipment; design, material, tolerance, welding and process standards; production processes and methods; and quality assurance. Of course, both the implementation of the new systems and methods and the measurement of their effectiveness will take time. The fact that these changes are occurring simultaneously with a five-ship new construction program compounds the problems ordinarily attendant to any first-of-a-kind new ship program. However, the transfer of this technology is proceeding and ultimately promises beneficial and profitable results.

At the start of the bulker program, the Levingston workforce numbered approximately 1,200. Now, some eleven months later, the workforce is at 1,650. The rapid increase and assimilation of new employees; the study, implementation and assimilation of new systems, processes, methods and techniques; and the construction of a class of five new ships is an ambitious and difficult task for any shipyard. But the potential benefits, both immediate and long range, diminish the difficulty of the undertaking into virtual obscurity. Levingston management is as dedicated to the program as ever, perhaps even more than at its inception. And, gradually, as the program accelerates, the yard workforce is recognizing and accepting benefits of Technology Transfer.

As part of its contract with MarAd, Levingston will present three industry seminars to provide details of its findings, system improvements and results as the program evolves.

From its inception and now, from a point approximately a third of the way through the program, the prospect of extraordinary success of the Technology Transfer Program appears certain both for Levingston and for American shipbuilding in general.

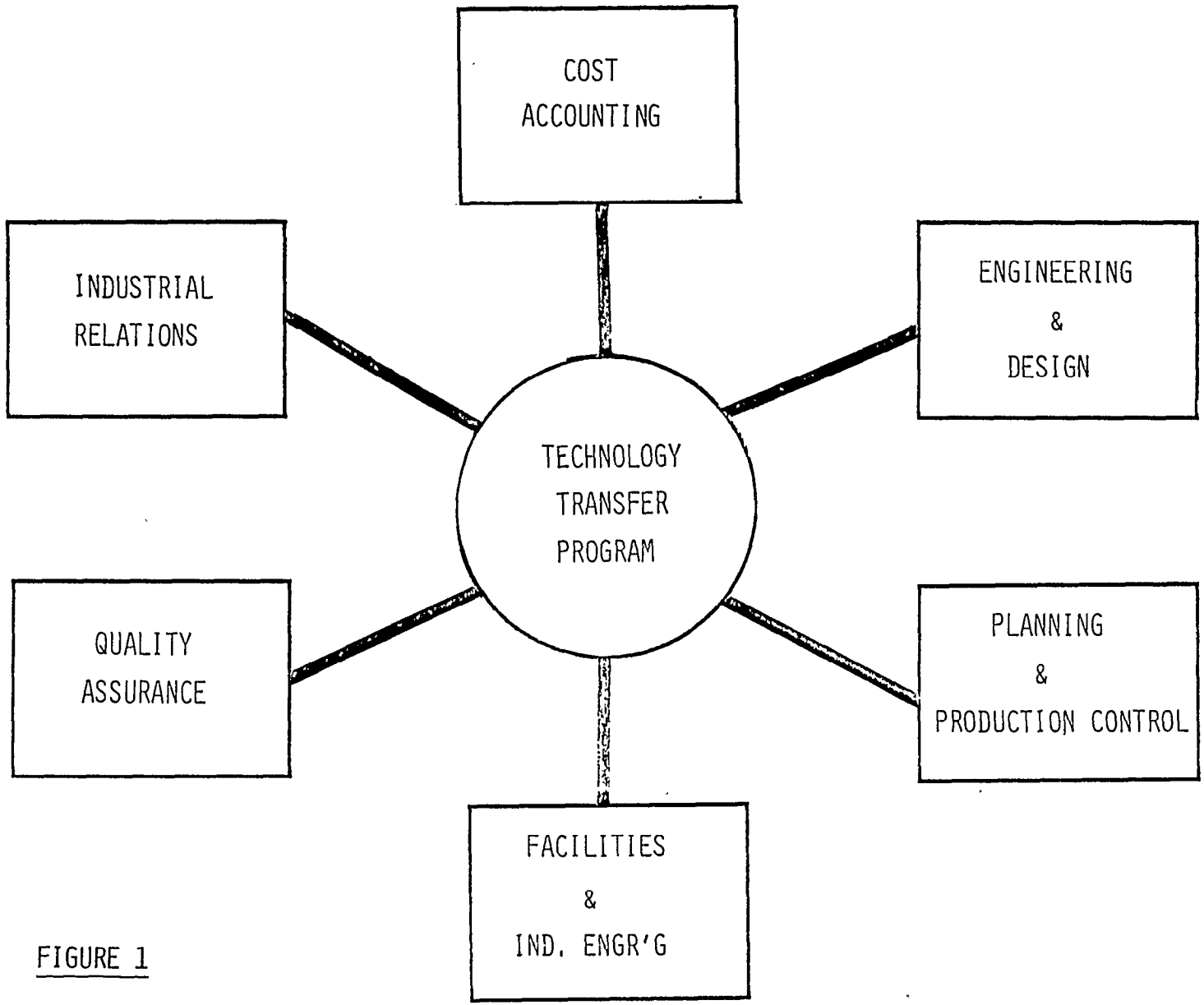
COST
ACCOUNTING
INDUSTRIAL
RELATIONS
ENGINEERING
&
DESIGN
TECHNOLOGY
TRANSFER
PROGRAM
QUALITY
ASSURANCE
PLANNING
&
PRODUCTION CONTROL
FACILITIES
&
IND. ENGR'G

FIGURE 1

TASK 1 - COST ACCOUNTING

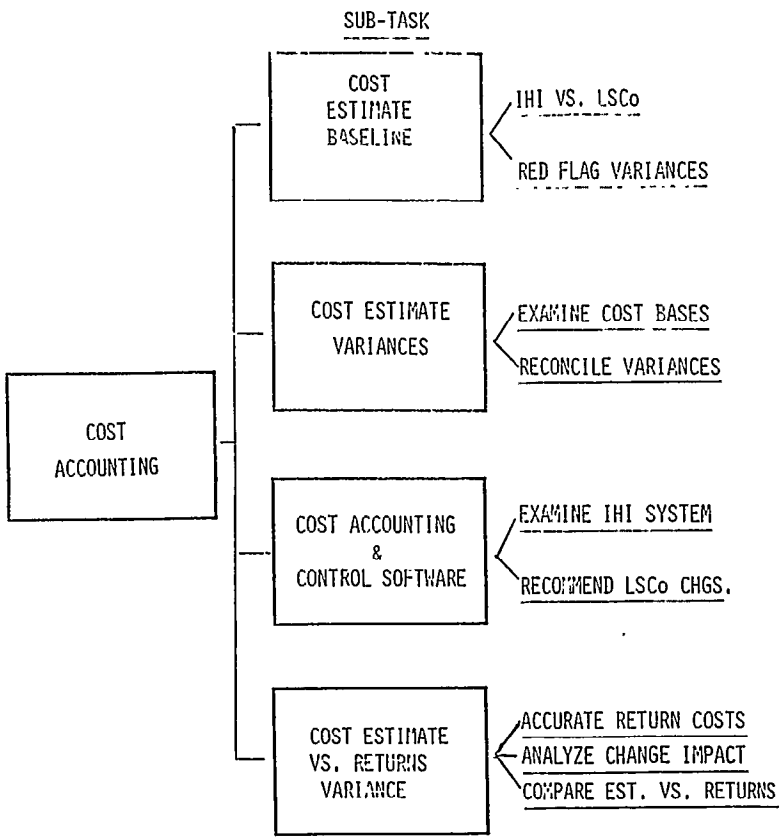

FIGURE 2

TASK 2 - ENGINEERING & DESIGN

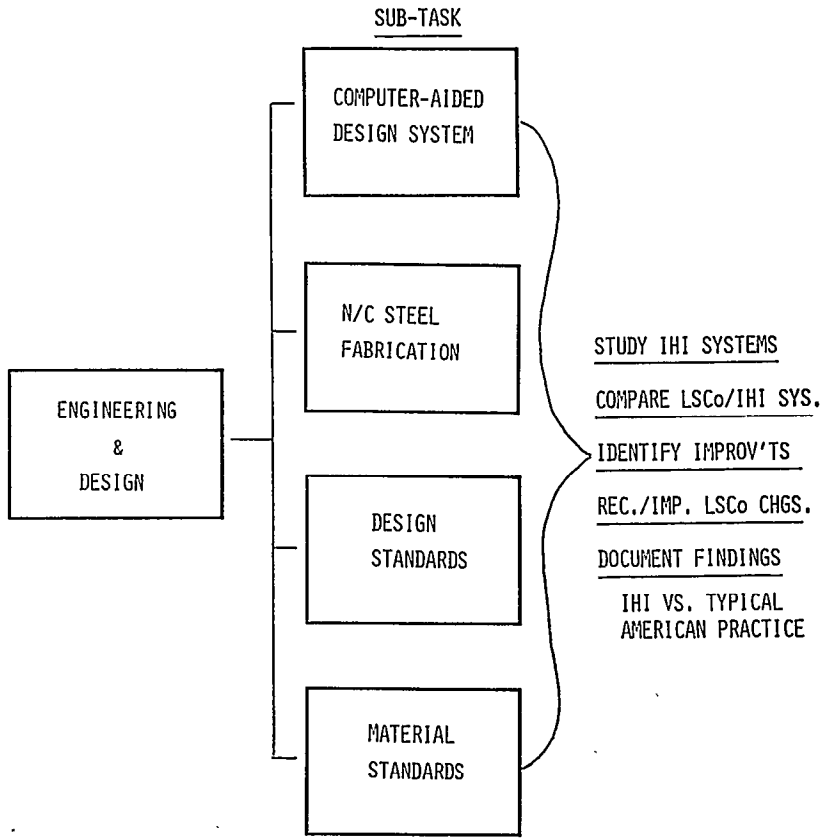

FIGURE 3

TASK 3 - PLANNING & PRODUCTION CONTROL

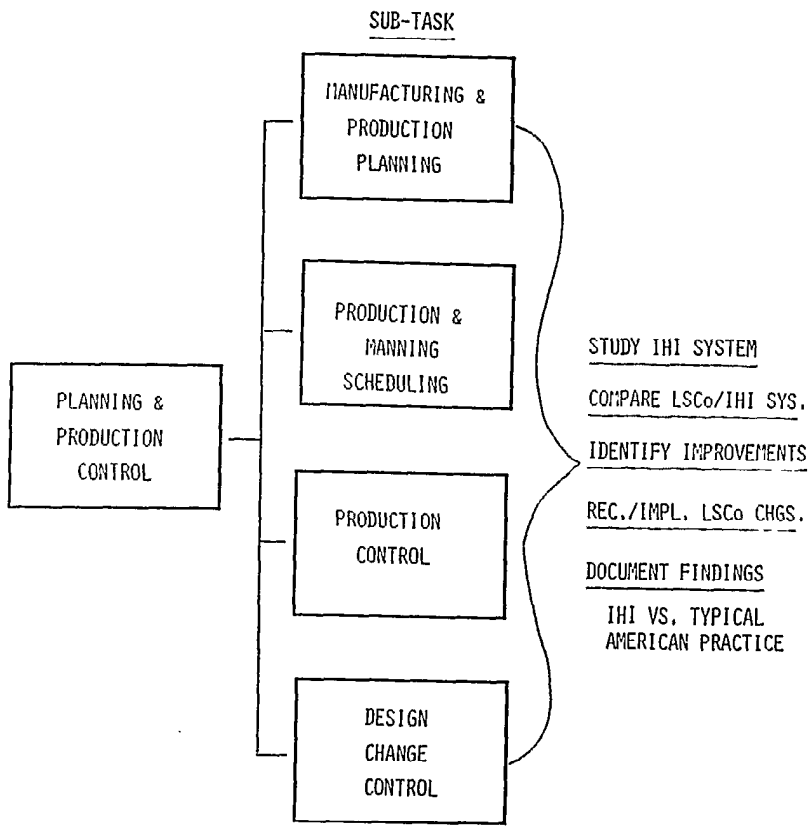

FIGURE 4

TASK 4 - FACILITIES & INDUSTRIAL ENGINEERING

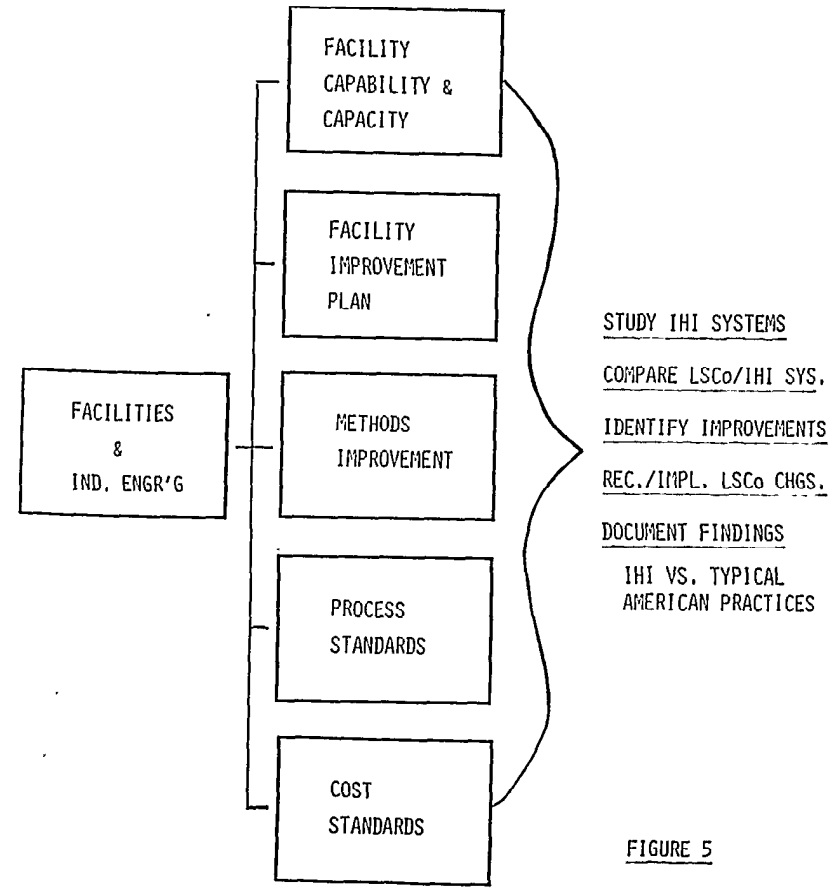

FIGURE 5

TASK 5 - QUALITY ASSURANCE

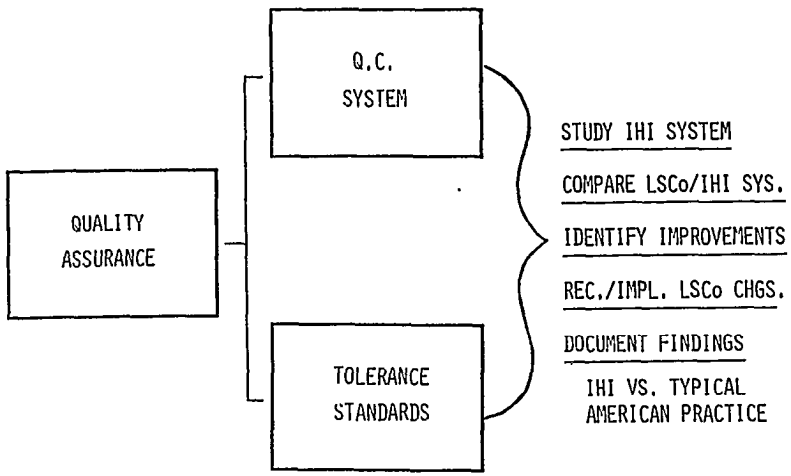

FIGURE 6

TASK 6 - INDUSTRIAL RELATIONS

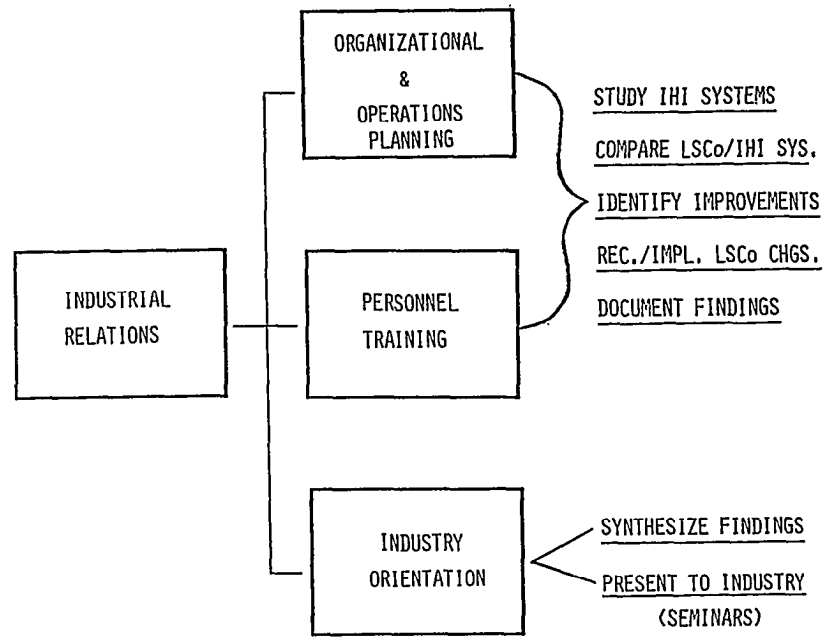

FIGURE 7

SIGNIFICANT FINDINGS TO DATE

PRODUCTIVITY VARIANCES ATTRIBUTABLE TO:

PERSONNEL

WORKER ATTITUDES - TENURE - LABOR/MANAGEMENT RAPPORT

FACILITIES

HIGHLY PERFECTED FOR ALL OPERATIONS

SUPERIOR APPLICATION OF TECHNOLOGY

SYSTEMS

INTEGRATED ENGR'G/PLANNING PRODUCTION SYSTEMS

IDENTIFIABLE RESPONSIBILITY AT ALL LEVELS

EXTENSIVE USE OF SUBCONTRACTORS

SIGNIFICANT FINDINGS TO DATE

COST VARIANCES ATTRIBUTABLE TO:

- HIGHLY AUTOMATED DESIGN/PRODUCTION SYSTEMS
- HIGHLY DEPENDABLE/EXPERIENCED WORK FORCE
- "FAMILY" OF SUBCONTRACTORS
- SERIES PRODUCTION W/MIN, CHANGE
- ACCOUNTING PRACTICES

SIGNIFICANT FINDINGS TO DATE

ENGINEERING & DESIGN

- FULL UTILIZATION OF COMPUTER-AIDED DESIGN SYSTEM

  HIGHLY PERFECTED DESIGN STANDARDS

- PRODUCTION ENGINEERING/PLANNING BY WORKSHOP STAFF

- ENGINEERING PERSONNEL AT ALL LEVELS

SIGNIFICANT FINDINGS TO DATE

PLANNING & PRODUCTION CONTROL

- LONG LEAD TIME FOR PLANNING (7 MOS.)

- DECENTRALIZED ENGR'G & PLANNING FUNCTIONS

- DETAIL PLANNING/SCHEDULING AT EVERY LEVEL

  HEAD OFFICE
  YARD PRODUCTION CONTROL
  ENGINEERING/PLANNING STAFFS
  FOREMEN

- STANDARDIZED METHODS/PROCESSES

SIGNIFICANT FINDINGS TO DATE

FACILITIES

' OPTIMUM MATERIAL FLOW & CONTROL

' "PROCESS LANES" CONCEPT

' PERFECTED OVER 30 YEARS

GOVERNMENT LOW COST LOANS

TAX BENEFITS

INTEREST SUBSIDIES

PLANT IMPROVEMENT SUBSIDIES

' EXCELLENT MAINTENANCE/CLEANLINESS

SIGNIFICANT FINDINGS TO DATE

INDUSTRIAL ENGINEERING

' HIGH UTILIZATION OF:

STANDARDS, JIGS & FIXTURES

MOVABLE PLATFORMS/SCAFFOLDING

HEAVY-LIFT CRANES

PALLETS

STANDARD METHODS/PROCESSES

' CONTINUING FACILITY/METHODS IMPROVEMENT

SIGNIFICANT FINDINGS TO DATE

QUALITY ASSURANCE

' ACCURACY CONTROL DIRECTS & CONTROLS ALL FUNCTIONS

' Q.C, PERFORMS MEASUREMENTS OF VITAL POINTS/DIMENSIONS

' "SELF-CHECK" SYSTEM
- GROUP CHECKER
- ASSISTANT FOREMAN
- Q.C,

' EMPHASIS ON PEOPLE ——→ QUALITY

SIGNIFICANT FINDINGS TO DATE

INDUSTRIAL RELATIONS

' PERSONNEL WELFARE IS ALL-IMPORTANT

' COOPERATIVE LABOR/MANAGEMENT ATTITUDE

' WORKER SAFETY IS PRIMARY CONCERN

' PERSONAL PRIDE IN WORKMANSHIP

' GROUP VS. INDIVIDUAL PERFORMANCE

' FRINGE BENEFITS - 60 TO 70%

' LIFE-TIME CONTRACT

' RECIPROCAL WORK ETHIC

KEYS TO HIGHER PRODUCTIVITY

1, WORKER ATTITUDES:

LOYALTY - DEPENDABILITY

WORKMANSHIP - DEDICATION

2, BALANCED-INTEGRATED DESIGN/PRODUCTION SYSTEM

3, SUPERB FACILITIES/EQUIPMENT

4, LABOR RELATIONS

5, PLANNING - PLANNING - PLANNING

6, GROUP IDENTITY